

ABSTRACT OF THE DISCLOSURE

A receiving beam is formed using 60 elements arranged in a 90° sector area of a cylindrical receiving array. Receiving beam 0 is formed with elements 0-59 divided into two (front and rear) groups. Specifically, the elements 0-59 are divided into rear group 1 (elements 0-8, 51-59) and front group 2 (elements 9-50) in the beam direction, and the receiving beam is formed by using sample data obtained from the transducer elements 0-8, 51-59 of group 1 in a current scanning cycle as well as sample data obtained from the transducer elements 9-50 of group 2 in a preceding scanning cycle. This approach makes it possible to form the receiving beam such that incoming waves of a short-pulse signal would simultaneously hit the relevant transducer elements of the receiving array and thereby improve directivity and sensitivity of the receiving beam for the reception of short-pulse waves.